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The Estimation of Alcohol-Related Healthcare Costs in Thailand: Evidence from Regional Data of Universal Health Coverage Beneficiaries in 2011

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Abstract

This paper is the first attempt to estimate the size of the healthcare costs accountable by alcohol consumption behavior among those under the Universal Health Coverage scheme across areas in Thailand in 2011. An estimation was completed for each administrative district classified by the National Health Security Office. Which was the financing agency of the scheme. The healthcare costs are estimated both for outpatient and inpatient services. Using data from various sources and a methodology generally employed in cost of illness studies, it was found that the total healthcare cost burden on the Universal Health Coverage scheme for services obtained in-district could range between 2.2-2.8 billion Thai Baht (roughly $73-$92 million) in 2011. District-specific analysis suggests that the areas with the highest alcohol-related outpatient healthcare costs are those with many industrialized zones. Meanwhile, areas with various tourist attractions incur the highest drinking-related inpatient cost. Non-communicable diseases imposing a high financial burden on this public health scheme include Hypertensive disease, AIDS, Haemorrhagic and other nonischaemic strokes, liver cancer, Oropharyngeal cancer, Alcoholic liver Cirrhosis, and Laryngeal cancer. The findings highlight the significantly large burden alcohol consumption imposes on Thailand.

Keywords: District-specific Healthcare Costs, Alcohol-attributable Fractions, Alcohol Consumption, Universal Health Coverage

1. Introduction

Alcohol consumption does not only impose a private cost on those who consume, but also imposes many external costs on society. The externality cost from alcohol consumption includes, but is not limited to, healthcare service costs in a welfare state, the cost of crimes conducted by intoxicated people (in terms of the jurisdiction process involved and the loss of victims), or even the cost of lost productivity from premature mortality or lower efficiency among workers who have drinking problems (Single et al., 2003). Government agencies in many countries take these externality problems seriously and try to quantify these costs in the hope that their society would have an accurate perception about the actual cost of alcohol consumption. For example, a study in 2007 in Scotland indicated that the direct cost of alcohol consumption in terms of healthcare service costs was between £143.6 and £392.8 million, while the cost from jurisdiction processes related to drinking misconduct was estimated to be as large as £462.5-£991.7 million, and the estimated cost in terms of lost productivity from premature mortality or absenteeism resulted from alcohol consumption was £725.2-£1,006.1 million (Scottish government, 2010). Studies in other countries provide a similar picture about the harmful impact alcohol consumption imposes on society; for example, the crime costs related to alcohol were approximated to be at least $1.4 billion in 2004/2005 in Australia (Collins & Lapsley, 2008), $3.1 billion in 2002 in Canada (Rehm et al., 2006), 2.9 billion Swedish Krona in 2002 in Sweden (Jarl et al., 2008), and $21 billion in 2006 in the United States (Bouchery et al., 2011). Meanwhile, healthcare service costs were estimated to be $2 billion in 2004/2005 in Australia (Collins & Lapsley, 2008), $3.3 billion in 2002 in Canada (Rehm et al., 2006), 2.2 billion Swedish Krona in 2002 in Sweden (Jarl et al., 2008) and $24.6 billion in 2006 in the U.S. (Bouchery et al., 2011). The largest portion of the societal cost of alcohol consumption usually comes from the intangible cost of lost productivity, either from

premature death, absenteeism, or long-term disability, which can be linked to alcohol consumption, and which is defined as the opportunity cost of output that a person could have produced were he/she in a perfect health (or not dead prematurely). This is an important cost component most societies ignore. These costs amounted to $4.5 billion in Australia (Collins & Lapsley, 2008), $7.1 billion in Canada (Rehm et al., 2006), 10.4 billion Swedish Krona in Sweden (Jarl et al., 2008), $161.3 billion in the U.S. (Bouchery et al., 2011) and $13.2 billion in 1990 in New Zealand (Easton, 1997). The most recent study in Thailand estimated each cost component to be as high as 5.5 billion Thai Baht for health cost, 240 million Thai Baht for crime cost, and 150 billion Thai Baht for lost productivity cost, with a total social cost accounting for 1.99 percent of the country's GDP in 2006 (HITAP, 2008).

In Thailand, public healthcare resources are concentrated the most in the Universal Health Coverage (UHC) scheme. Among the three health insurance schemes currently available, its coverage includes up to 75% of the Thai population, and the government budget directed toward the scheme was 122-141 billion Thai Baht for capitation budget[2] only from 2011-2014 (NHSO, 2011-2014). The scheme allows free healthcare services for its beneficiaries, financed through general tax revenue. This implies that the majority of the resources used under this scheme are a cost on society at large. Given the direct link between resources used by the UHC scheme and the social financial burden, this paper tries to evaluate the size of alcohol-related healthcare costs among those under the UHC scheme in Thailand in 2011. Cost from the public health facility's perspective is used in this study as the proxy of public healthcare resources utilized. The estimation of cost is done for each area administered by the National Health Security Office (NHSO) district branch, the local financing agency of the UHC scheme. This practice is motivated partly by the fact that alcohol consumption problems could vary across areas (Sarakarn et al., 2009; Onmoy, 2010; Kittinorarat & Sanitlhuer, 2011; Boonchaisaen et al., 2012; Pakdeekul et al., 2012; Peungchuer, 2012) To the best of our knowledge, there are no works in Thailand that have ever conducted an estimation at the NHSO-district level, this could be considered the first.

[2] There are many other categories of budget, e.g. HIV/AIDS patient budget, Tuberculosis patient budget, Renal Failure patient budget.

The results would shed light on the distribution of the alcohol-related healthcare cost burden across each area in Thailand.

The paper begins with the background regarding social health insurances in Thailand. Section 3 discusses the methodology employed in the paper. The sources of relevant data are explained in Section 4. Section 5 reports the findings and discussion. Section 6 elaborates results under sensitivity analyses. Limitations of the study are discussed in Section 7; the last section concludes the paper.

2. Thailand Social Health Insurance System

2.1 Background

According to the Thailand Health Profile Report 2008-2010, Healthcare Reform in 2002 consolidated various social health insurance schemes in an attempt to provide financial protection against catastrophic healthcare spending for all Thai citizens. Currently, only three social health insurance schemes remain: the Civil Servants Medical Benefits (CSMBS), the Social Security Scheme (SSS) and the Universal Health Coverage scheme (UHC).

2.1.1 Civil Servants Medical Benefits Scheme (CSMB)

Civil servants in the Thai government or permanent employees in a state enterprise and their immediate relatives (spouses, children under 18, parents) are qualified to receive free healthcare at public hospitals of their choice. The scheme was originally established to compensate for their lower-than-market salary. The beneficiaries of the program would get full reimbursement for any outpatient expenses incurred at public hospitals from the Ministry of Finance. In 2007, the responsible agency began to pay the facilities directly, so the patients are not required to pay anything. This approach has long been applied to inpatient services, where hospitalization costs are reimbursed directly by the government (Ministry of Finance). The program suffered from rising expenditures since the reimbursement was done on a Fee-For-Service (FFS) basis.[3] An attempt to contain the cost of the

[3] Fee-For-Service means that the service costs are reimbursed in full by the responsible agencies.

program was initiated in 2007 by employing the DRG[4] system for inpatient services (FFS still applies for outpatient services, with additional conditions). It is financed entirely by general tax revenue. The program covered 9**%** of Thai population in 2009 (Thailand Health Profile Report 2008**-**2010).

2.1.2 Social Security Scheme (SSS)

Following the Social Security Act (1990), employees of an enterprise have been mandated to participate in the Social Security Scheme. Employers are required to transfer 3**%** of its employees' earnings to the Social Security Office every month (1.5**%** from employees' salary and another 1.5**%** from employer's earnings). The government contributes another 1.5**%**. It is basically a tripartite scheme. Part of the collected fund would be used to pay the healthcare costs of its beneficiaries on the basis that the workers have to obtain services at the assigned (public or private) facilities (Social Security Office, 2016).

The funds were also used for unemployment insurance payments, maternity leave payments, and pensions. The scheme employs both capitation[5] and Fee**-**For**-**Service to reimburse the healthcare costs. Around 12**%** of Thai population were under SSS in 2009 (Thailand Health Profile Report 2008**-**2010).

2.1.3 Universal Health Coverage (UHC)

The Universal Health Coverage scheme was piloted in Thailand in 2001. The scheme expanded to cover the whole country in 2002. The National Health Security Office (NHSO) was established to be the operating agency for the entire scheme following the National Health Security Act of 2002. The scheme provided health insurance to those without formal coverage, i.e., those not eligible for CSMBS or SSS benefits. The scheme provides both curative and preventative services at public health facilities. Each person under the scheme has to register at a primary care unit near his/her residence and begins every treatment process at this registered unit. Referral to more advanced facilities is possible, depending on the physician's discretion.

[4] Diagnosis Related Group, the facility is reimbursed based on the disease classification of the patient.

[5] Each registered beneficiary is assigned fixed amount of reimbursement.

Before 2006, a co-payment of 30 Baht for each visit was in place; however, the co-payment was abolished in 2006 and currently, the beneficiaries could obtain services under the benefit package free of charge. The scheme employs a capitation payment system for most ambulatory care and health prevention and promotion services. The DRG payment system under global budget is employed for all inpatient services in an attempt to control the overall cost of the scheme. The whole scheme is financed through general tax revenue. The scheme covered 74% of Thai population in 2009 (Thailand Health Profile Report 2008-2010).

Since this paper will focus only on the cost relevant to those under the UHC scheme, it would be useful to understand the organizational structure of the main responsible agency, the National Health Security Office (NHSO).

2.2 Organizational Structure of the NHSO

According to the National Health Security Handbook for fiscal year 2011 (NHSO, 2011), the administration of the National Health Security Office is decentralized into two different levels, namely, provincial and district levels. Each NHSO district office serves many provinces in different regions. They are the main contractors with private providers and public providers not affiliated with the Ministry of Public Health. Provincial offices are the main contractor with public providers under the Ministry of Public Health.

The main responsibilities of the district offices include, but are not limited to, quality assurance of the contracted providers, facilitating the registration of newly contracted providers, managing the referral process across the provider network, disseminating information about the providers under its administration, managing the fund for different services, and encouraging the involvement of local administrative bodies in the health security system. Provincial offices are expected to facilitate the administration of the district offices. The following table provides information regarding provinces administered by each district office.

Table 1. Provinces under each NHSO district office.

NHSO District Office	Provinces under the administration
1	Chiang Mai, Chiang Rai, Phayao, Mae Hong Son, Nan, Lampang, Lamphun, Phrae
2	Phitsanulok, Tak, Phetchabun, Sukothai, Uttaradit
3	Nakorn Sawan, Kam Paeng Phet, Chai Nat, Phichit, Uthai Thani
4	Saraburi, Lop Buri, Singburi, Ang Thong, Phra Nakhon Si Ayutthaya, Nonthaburi, Nakhon Nayok, Pathum Thani
5	Ratchaburi, Kanchanaburi, Prachuap Khiri Khan, Phetchaburi, Samut Songkhram, Nakon Pathom, Suphan Buri, Samut Sakhon
6	Rayong, Chanthaburi, Chachoengsao, Chon Buri, Trat, Prachinburi, Samut Prakan, Sa Kaeo
7	Khon Kaen, Kalasin, Maha Sarakham, Roi Et
8	Sakon Nakhon, Udon-Thani, Nakhon Phanom, Nong Khai, Nong Bua Lam Phu, Loei
9	Nakhon Ratchasima, Chaiyaphum, Buri Ram, Surin
10	Ubon Ratchathani,Mukdahan, Yasothon, Si Sa Ket, Am Nat Chareon
11	Surat Thani, Krabi, Chumphon, Nakorn Si Thammarat, Phangnga, Phuket, Ranong
12	Songkhla, Trang, Narathiwas, Pattani, Phatthalung, Yala, Satun
13	Bangkok

Source: the National Health Security Handbook, National Health Security Office (2011).

The healthcare cost burden attributable to alcohol consumption will be estimated by NHSO-district in this study.

3. Methodology

The two most important figures that must be calculated in the estimation of alcohol-related healthcare costs are the Alcohol Attributable Fractions and the total healthcare costs of the country. The formula and relevant parameters employed are explained below.

3.1 Alcohol Attributable Fractions

By definition, alcohol-attributable fraction refers to the proportion of the incidence of particular disease group which is caused by the consumption of alcohol. The estimates of AAF could provide the number of cases at healthcare facilities projected to be related to alcohol consumption.

Following the work by Walter (1976, 1980), the alcohol-attributable fraction for each disease group could be calculated using

$$AAF_j = \sum_{i=0}^{k} P_i(RR_{ij} - 1) \Big/ \left(\sum_{i=0}^{k} P_i(RR_{ij} - 1) + 1 \right) \quad (1)$$

Where AAF_j = Alcohol Attributable Fraction of disease group j, P_i = prevalence rate of alcohol consumption level i in the population, with $i = 0$ refer to those with complete abstinence, RR_{ij} = Relative Risk of developing disease group j among those with alcohol consumption level i compared to abstainers, k = Total number of alcohol consumption levels used in the calculation (=3). The number of alcohol consumption level used in the formula is three levels, i.e., moderate drinking level, heavy drinking level, and hazardous drinking level, based on many epidemiological studies (See Walter 1976, 1980; English et al., 1995; Gutjahr et al., 2001; Ridolfo et al., 2001; Rehm et al., 2003, 2006, 2010; HITAP, 2008)

3.1.1 Prevalence Rate

Prevalence rate of different level of alcohol consumption refers to the proportion of the population reported to consume alcohol at different level

during a particular time period. The rates among Thai population are calculated from the type of beverage, the number of unit, and the frequency of consumption a person reported in a national survey. According to Rehm, Patra & Popova (2006), three levels of alcohol consumption is defined for each gender. For males, consumption of alcohol volume between 0.25 and 39 millilitre per day is considered moderate drinking, 40-60 millilitre per day is considered heavy drinking, and more than 60 millilitre per day is considered hazardous drinking. The figures for females are 0.25-19, 20-40, and more than 40 millilitre per day, respectively (Rehm et al., 2006).

3.1.2 Diseases

Studies of the health costs of alcohol consumption generally use a different set of disease groups that could be related to alcohol consumption behavior, since disease prevalence varies between countries. Among the literature reviewed, there are some common disease groups that were observed in every study, and some that are unique to each country (Rehm et al., 2006; Collins & Lapsley, 2008; Jarl et al., 2008; Scottish government, 2010). In order to be compatible with Thailand's pattern of diseases, the groups of diseases included in this study follow those employed in the study by the Health Technology Assessment Project Group (HITAP, 2008).

3.1.3 Relative Risk

The risk of developing a particular disease group among those consuming different levels of alcohol relative to abstainers comes from various epidemiological studies that use experimental settings to observe disease occurrences among different groups of people. This study uses the values reported in meta-analyses conducted in Rehm et al. (2010).

3.2 Healthcare Cost Estimation

Due to different resource levels used by different services, estimations of each type of healthcare costs are explained below.

3.2.1 Outpatient Care

The cost of outpatient services are calculated using the following formula,

$$Cost_{UC}^{OPD} = \sum_{i=1}^{n} N_{iOPD}^{a} * Cost_{iOPD}; N_{iOPD}^{a} = AAF_i * N_{iOPD}^{T} \quad (2)$$

where AAF_i = Alcohol Attributable Fraction of disease group i, N_{iOPD}^{T} = Total number of outpatient visits to treat disease group i, N_{iOPD}^{a} = Number of visits to treat disease grou i pattributable to alcohol consumption, $Cost_{iOPD}$ = Average cost per visit to treat disease group i, n = Total number of disease groups.

3.2.2 Inpatient Care

The cost of inpatient services are calculated using the following formula,

$$Cost_{UC}^{IPD} = \sum_{i=1}^{n} N_{iIPD}^{a} * Cost_{iIPD}; N_{iIPD}^{a} = AAF_i * N_{iIPD}^{T} \quad (3)$$

where AAF_j = Alcohol Attributable Fraction of disease group i, N_{iIPD}^{T} = Total number of inpatient admissions to treat disease group i, N_{iIPD}^{a} = Number of inpatient admissions to treat disease group i attributable to alcohol consumption, $Cost_{iIPD}$ = Average cost per admission to treat disease group i, n = Total number of disease groups.

4. Data

Due to many parameters involved, different sources of data are needed in the estimation process, each source and the information it provides are described below.

4.1 The Cigarette Smoking and Alcoholic Drinking Behaviour Survey 2011

The gender-specific prevalence rates of different alcohol consumption levels come from the national survey by the National Statistical Office of Thailand, namely, the Cigarette Smoking and Alcoholic Drinking Behaviour Survey in 2011. This survey is conducted every 3 years across Thailand and provides information regarding smoking and drinking behaviors, such as frequency, volume, expenses, and abusive behaviors, as well as socio-economic and demographic characteristics of the respondents. The sample size was roughly 150,000 in 2011. The type of beverage, frequency and volume consumed during the last 30 days are combined with the assumption about

the percentage of alcohol contained in each type of beverage (Table 2) to convert the respondents' answers to alcohol level consumed daily. The national prevalence rates by gender are used in equation (1) to calculate the national Alcohol Attributable Fractions.

Table 2. Percent of alcohol volume contained in each type of beverage.

Type of Beverage	% alcohol (% Volume/Volume)
Vodka	40
Beer	5
Domestically produced Liquor	35
Imported Liquor	35
Wort	12
Locally brewed Liquor	40
Wine /Champaign	12
Brandy /Whisky	40
Wine Cooler	5
Chinese Liquor	35
Thai Herbal liquor	40

Source: HITAP (2008)

4.2 Epidemiological Studies on Relative Risk of Diseases

Rehm et al. (2010) reviewed the results from various epidemiological studies to identify the causal relationship between different drinking patterns and diseases or injuries, and they also conducted new meta-analyses as deemed necessary in order to identify the dose-response relationships. The relative risk figures from the systematic review and new meta-analyses were reported for each disease group. The parameters reported are used in equation (1) to calculate the Alcohol Attributable Fraction for each disease group.

4.3 The Service Records from the National Health Security Office

In order to quantify the size of public health resources used in the treatment of diseases causally related to drinking behavior, this study employs the cost information collected by the NHSO in 2011.

4.3.1 Outpatient Care

Despite the fact that each contracted facility under the NHSO gets a fixed budget for each patient registered at that facility (capitation-based), each facility is requested, for the purpose of annual budget planning, by the NHSO to report the actual costs incurred (treatment cost and drug cost) for each episode of outpatient service to the district branch. Each OPD record contains an ICD-10 code and cost information. For convenience, all the ICD-10 codes are truncated to a 4-digit length before being grouped in this study.[6] Records from every health facility in each district are used to calculate the average cost of treatment per episode and the total number of episodes for each group of alcohol-related diseases. The records are obtained from the Bureau of Executive Information Administration under the National Health Security Office. The total number of observations for OPD cost records across Thailand in 2011 before disease grouping was approximately 46.8 million.[7]

4.3.2 Inpatient Care

The inpatient service resources used vary according to type of disease, severity of each admission, and the treatment procedures chosen by the physician. The third-party reimbursement system is well-known as having a problem of supplier-induced demand, which is the cause of higher-than-necessary procedures/costs reported (Evans, 1974; Fuchs, 1978; McGuire, 2000). In order to mitigate the possibly exaggerated figures of inpatient cost by hospitals, this study uses the reimbursement rules employed by the NHSO as the proxy of health resources used for inpatient treatment. Given the data available from the NHSO, these rules yield the best possible cost measures.

Every contracted health facility has to record the Diagnosis Related Group (DRG) codes[8] for the primary cause of each admission. This code would then be converted into the Relative Weight (RW), which reflects the value of resources used for that treatment. This RW would then be multiplied

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[6] Outpatient records from the NHSO is the only dataset with the ICD-10 information which allows the grouping of diseases (outpatient records from the CSMBS scheme do not contain disease information).

[7] Each visit could contain more than one ICD-10 code, so more than one treatment cost records could be corresponding to each visit. Each cost record is treated as 1 unit of observation.

[8] This code is the derivative of the ICD-10 codes, as it has to be combined with the code of procedures done by the physician(s).

by the reimbursement rate per 1 RW, which was set by each NHSO district office. However, because many similar treatments could result in different lengths of stay, depending on various factors, such as treatment outcome, patient's health, etc., these Relative Weights are normally adjusted by the patient's length of stay, yielding the Adjusted Relative Weights (AdjRW) index for each admission. The facility would be paid using this index for each stay and the reimbursement rate per 1 AdjRW, these rates vary across administrative districts. For inpatient services offered to those registered within the district, the rates are displayed in Table 3; however, for inpatient services offered to those registered outside the district, the reimbursement rate is guaranteed at 9,000 Thai Baht per 1 AdjRW. Weighted average reimbursement rates per 1 AdjRW for each NHSO-district for the calendar year 2011 are used in this study.[9]

Table 3. Reimbursement rate per 1 AdjRW for each NHSO district office.

NHSO District Office	Fiscal Year 2011	Fiscal Year 2012	Calendar Year 2011
1	7,700.00	7,907.00	7,751.75
2	7,800.00	8,071.00	7,867.75
3	7,700.00	8,364.00	7,866.00
4	7,800.00	8,333.00	7,933.25
5	7,700.00	8,172.00	7,818.00
6	8,000.00	8,146.00	8,036.50
7	7,900.00	8,218.00	7,979.50
8	7,900.00	8,527.00	8,056.75
9	7,800.00	8,273.00	7,918.25
10	7,900.00	8,274.00	7,993.50
11	8,000.00	8,200.00	8,050.00
12	8,200.00	8,607.00	8,301.75
13	8,000.00	8,000.00	8,000.00

Source: The Bureau of Executive Information Administration, National Health Security Office and the author's calculation.

[9] Weights are number of months using each rate.

Therefore, equation (3) is modified as followed,

$$Cost_{UC}^{IPD} = \sum_{i=1}^{n} N_{iIPD}^{a} * ADJRW_i * \overline{Cost}; N_{iIPD}^{a} = AAF_i * N_{iIPD}^{T} \quad (4)$$

where $ADJRW_i$ = Average AdjRW per inpatient admission from disease group i, $\overline{Cost}$ Reimbursement rate per 1 AdjRW.

Admission records with all necessary information (ICD-10, AdjRW, registration status) are obtained from the Bureau of Executive Information Administration under the National Health Security Office. The total number of inpatient admissions before disease grouping is approximately 5.6 million across Thailand in 2011.[10]

4.3.3 Special OPD

Since the outpatient records from health facilities are distinguished between normal services and special cases, it is possible to calculate the separate cost for this category. These are accidents or emergency cases, or OPD cases for diseases with high cost of care. The reimbursement comes from different funds if the services were obtained outside the registered district. The within-district records are examined the same way as outpatient cost in 4.3.1. The total number of observations was roughly 1.3 million across Thailand in 2011, and the records come from the same agency as OPD and IPD records.

To summarize, the parameters used in the estimation of alcohol-related healthcare costs are obtained from different sources as shown in the following table.

[10] Each admission record contains one primary ICD-10 code and one corresponding AdjRW value. Each admission record is treated as 1 unit of observation.

Table 4. Summary of data sources.

Parameter (definition)	Data Source
RR_i (Relative Risk)	Epidemiological paper (Rehm et al. (2010))
P_i (Prevalence rate)	The Cigarette Smoking and Alcoholic Drinking Behaviour Survey 2011
$Cost_{iOPD}$ (Average cost per outpatient episode)	Bureau of Executive Information Administration, National Health Security Office and the author's calculation.
$ADJRW_i$ (Average Adjusted RW)	Bureau of Executive Information Administration, National Health Security Office and the author's calculation.
$\overline{Cost}$ (Average reimbursement rate per 1 AdjRW)	Bureau of Executive Information Administration, National Health Security Office and the author's calculation.

Source: The author.

5. Results and Discussion

The results of all analyses are as follows.

5.1 Alcohol Attributable Fractions

The national prevalence rates of different alcohol consumption levels (Table 5) and the relative risks of different groups of diseases, are combined using equation (1) to yield the national Alcohol Attributable Fractions (AAFs) in Table 6.

Table 5. Gender-specific alcohol consumption prevalence rates.

Male				
NHSO District Office	**Abstainer (%)**	**Moderate Drinking (%)**	**Heavy Drinking (%)**	**Hazardous Drinking (%)**
1	19.94	16.67	7.80	37.89
2	21.90	18.15	8.99	30.40
3	35.70	13.69	4.56	27.38
4	36.95	11.54	4.26	28.97
5	43.73	11.11	4.29	24.91
6	34.04	15.46	5.28	29.58
7	22.00	19.96	9.15	29.67
8	21.61	25.15	6.48	29.02
9	28.66	22.21	5.74	25.58
10	25.00	19.67	5.89	29.13
11	44.13	13.53	4.92	20.52
12	63.86	9.05	2.39	11.32
13	45.70	10.40	4.33	24.21
National	33.84	16.01	5.67	26.90

Table 5. Gender-specific alcohol consumption prevalence rates (cont.).

Female				
NHSO District Office	**Abstainer (%)**	**Moderate Drinking (%)**	**Heavy Drinking (%)**	**Hazardous Drinking (%)**
1	65.78	4.33	3.99	5.92
2	73.82	2.95	1.99	4.56
3	83.15	1.80	0.82	3.46
4	88.24	1.07	1.40	3.69
5	90.74	1.18	0.65	2.36
6	84.98	1.90	1.62	3.74
7	78.11	3.18	2.33	2.00
8	78.93	3.02	2.05	2.28
9	84.30	4.65	1.28	3.03
10	85.72	2.97	0.78	1.51
11	93.89	1.13	0.23	1.09
12	97.25	0.41	0.18	0.32
13	89.67	0.88	1.18	1.88
National	84.20	2.29	1.45	2.73

Source: Author's calculations from the Cigarette Smoking and Alcoholic Drinking Behaviour Survey 2011 (For males, moderate drinking is equivalent to taking 0.25-39 ml. alcohol per day, while heavy drinking is equivalent to 40-60 ml. alcohol per day, and hazardous drinking is equivalent to taking more than 60 ml. alcohol per day. For females, the figures are 0.25-19, 20-40, and more than 40 ml. per day, respectively (Rehm et al. (2003, 2010)). All respondents are included for the calculation of abstainer rate. Only those with reported consumption volume are included in the calculation of different consumption rates. Only those 15 years old and above are included.

Table 6. Gender-Specific Alcohol Attributable Fractions by disease group (National AAFs)[11]

Disease Name	AAF: Male (Moderate Drinking)	AAF: Female (Moderate Drinking)	AAF: Male (Heavy Drinking)	AAF: Female (Heavy Drinking)	AAF: Male (Hazard Drinking)	AAF: Female (Hazard Drinking)	Overall AAF Male	Overall AAF Female
Pancreatitis - acute/chronic	0.0081	0.0021	0.0131	0.0060	0.4746	0.0865	0.4959	0.0946
AIDS	0.0640	0.0124	0.0412	0.0143	0.1956	0.0269	0.3009	0.0535
Mental and behavioural disorders due to use of alcohol : harmful use	-	-	-	-	-	-	1.0000	1.0000
Alcoholic cardiomyopathy	-	-	-	-	-	-	1.0000	1.0000
Mental and behavioural disorders due to use of alcohol : dependence syndrome	-	-	-	-	-	-	1.0000	1.0000
Alcoholic gastritis	-	-	-	-	-	-	1.0000	1.0000
Alcoholic polyneuropathy	-	-	-	-	-	-	1.0000	1.0000
Mental and behavioural disorders due to use of alcohol : acute intoxication, withdrawal state, unspecified mental and behavioural disorder	-	-	-	-	-	-	1.0000	1.0000
Cholelithiasis	-0.0353	-0.0042	-0.0222	-0.0047	-0.1643	-0.0140	-0.2219	-0.0229
Alcohol-induced chronic pancreatitis	-	-	-	-	-	-	1.0000	1.0000
Alcoholic liver cirrhosis	0.0101	0.0047	0.1013	0.0845	0.6784	0.2247	0.7898	0.3140

[11] Any disease with the word “alcohol” in its name is automatically assigned 100% AAF.

Table 6. Gender-Specific Alcohol Attributable Fractions by disease group (National AAFs) (cont.)

Disease Name	AAF: Male (Moderate Drinking)	AAF: Female (Moderate Drinking)	AAF: Male (Heavy Drinking)	AAF: Female (Heavy Drinking)	AAF: Male (Hazard Drinking)	AAF: Female (Hazard Drinking)	Overall AAF Male	Overall AAF Female
Degeneration of nervous system due to alcohol	-	-	-	-	-	-	1.0000	1.0000
Diabetes mellitus	-0.0214	0.0000	-0.0076	-0.0058	0.0028	0.0005	-0.0262	-0.0053
Epilepsy and Status epilepticus	0.0337	0.0078	0.0276	0.0115	0.3720	0.0612	0.4333	0.0805
Ethanol	-	-	-	-	-	-	1.0000	1.0000
Finding alcohol in blood	-	-	-	-	-	-	1.0000	1.0000
Female breast cancer	-	0.0071	-	0.0065	-	0.0122	-	0.0259
Foetus and newborn affected by maternal use of alcohol	-	-	-	-	-	-	1.0000	1.0000
Heart failure	-0.3129	-0.0245	-0.1104	-0.0155	-0.5238	-0.0292	-0.9470	-0.0692
Ischaemic stroke	-0.0395	-0.0063	-0.0020	-0.0006	0.1631	0.0186	0.1215	0.0117
Hypertensive Disease	0.0265	0.0052	0.0232	0.0110	0.2909	0.0463	0.3406	0.0625
Ischaemic heart disease	-0.0301	-0.0041	-0.0100	-0.0023	0.0000	0.0033	-0.0401	-0.0032
Haemorrhagic and other nonischaemic stroke	-0.0024	-0.0004	0.0081	0.0027	0.2396	0.0311	0.2453	0.0334
Laryngeal cancer	0.0364	0.0089	0.0305	0.0134	0.4057	0.0708	0.4727	0.0931
Liver cancer	0.0240	0.0042	0.0178	0.0056	0.1714	0.0214	0.2133	0.0313
Preterm birth complications	0.0000	0.0000	0.0201	0.0057	0.0952	0.0107	0.1153	0.0164
Toxic Effect of Methanol	-	-	-	-	-	-	1.0000	1.0000
Oropharyngeal cancer	0.0507	0.0164	0.0439	0.0255	0.5382	0.1241	0.6329	0.1660
Oesophageal cancer	0.0346	0.0082	0.0291	0.0123	0.3845	0.0647	0.4482	0.0852

Table 6. Gender-Specific Alcohol Attributable Fractions by disease group (National AAFs) (cont.)

Disease Name	AAF: Male (Moderate Drinking)	AAF: Female (Moderate Drinking)	AAF: Male (Heavy Drinking)	AAF: Female (Heavy Drinking)	AAF: Male (Hazard Drinking)	AAF: Female (Hazard Drinking)	Overall AAF Male	Overall AAF Female
Oesophagealvaricies	0.0109	0.0044	0.1267	0.0909	0.6009	0.1711	0.7384	0.2663
Other neoplasms	0.0132	0.0022	0.0139	0.0042	0.1542	0.0186	0.1813	0.0251
Psoriasis	0.0643	0.0126	0.0235	0.0082	0.2226	0.0311	0.3104	0.0519
Gastric cancer	0.0914	0.0061	0.0317	0.0037	0.4029	0.0372	0.5260	0.0470
Supraventricular cardiac dysrhythmias	0.0181	0.0029	0.0093	0.0027	0.1050	0.0121	0.1325	0.0177
Unipolar major depression	-	-	-	-	-	-	-	-
Fall injuries	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955
Fire injuries	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955
Drowning	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955
Aspiration	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955
Occupational and machine injuries	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955
Suicide and self-Inflicted injury	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955
Child abuse & Assault	0.0333	0.0083	0.0294	0.0131	0.4186	0.0741	0.4813	0.0955

Source: Author's calculation.

Table 6 shows that, given the national prevalence rates of different alcohol consumption levels among Thai males and females in 2011, 49.59% and 9.46% of the occurrence of acute/chronic Pancreatitis among males and females, respectively, is associated with alcohol drinking behavior.[12] These findings are somewhat comparable with those found in previous studies in Thailand (for acute/chronic Pancreatitis, male and female AAFs were estimated to be 36.1% and 9.9% in 2006, respectively. See HITAP (2008)), differences found could be contributed to different data sources of alcohol consumption prevalence rates and the changes in drinking patterns among Thai people over time. In the 2006 study, the alcohol consumption prevalence rates were obtained from the Third Thai National Health Examination Survey in 2003-2004, conducted by the Health System Research Institute, Ministry of Public Health, which is a different survey from the one used in this study (HITAP, 2008). As noted in Jarl et al. (2006), differences in findings across the countries (or same country over time) could be the result of different consumption patterns, diseases structures, societal norms and values, or different institutional systems regarding disease treatment or even different alcohol policies.

5.2 Healthcare Cost Estimation

Each type of healthcare costs related to alcohol consumption by NHSO-district is shown below.

[12] The summation of AAF at different alcohol consumption level to obtain overall AAF for each gender follows the formula in equation (1), with the different alcohol consumption prevalence rates being calculating weights.

Table 7. NHSO district-specific OPD IPD and Special OPD Cost attributable to alcohol (based on National AAFs)

NHSO District Office	OPD cost (Baht)	IPD cost (Baht)	Special OPD cost (Baht)	Total cost (Baht)
1	148,589,391.48	123,733,242.88	5,532,733.55	277,855,367.91
2	121,769,190.61	53,530,440.43	4,125,845.59	179,425,476.63
3	69,363,241.29	39,591,309.84	388,183.11	109,342,734.24
4	62,620,633.19	53,812,696.69	16,497,628.66	132,930,958.54
5	132,127,539.21	59,919,760.40	3,220,453.62	195,267,753.23
6	306,564,403.80	82,693,949.31	2,234,495.58	391,492,848.69
7	74,935,170.80	59,016,202.38	4,102,346.02	138,053,719.20
8	74,141,051.91	57,200,181.92	3,003,191.49	134,344,425.32
9	82,874,215.08	98,281,914.54	4,271,621.65	185,427,751.27
10	65,617,796.78	58,710,588.88	6,241,180.24	130,569,565.90
11	85,374,233.25	43,197,270.96	1,289,456.70	129,860,960.91
12	101,964,636.62	40,657,092.37	6,324,393.36	148,946,122.35
13	N/A	66,519,162.91	8,746,518.52	75,265,681.43
Total (Within-district services ONLY)	1,325,941,504.02	836,863,813.51	65,978,048.09	2,228,783,365.61
Total (Out-of-district services included)				2,527,618,208.90

Source: Author's calculation.

Table 8. NHSO district-specific OPD IPD and Special OPD Cost attributable to alcohol per beneficiary (based on National AAFs)

NHSO District Office	OPD cost per Beneficiary (Baht)	IPD cost per Beneficiary (Baht)[13]	Special OPD cost per beneficiary (Baht)[14]	Total cost per beneficiary (Baht)
1	35.34	29.43	1.32	66.08
2	46.31	20.36	1.57	68.24
3	29.79	17.00	0.17	46.96
4	19.74	16.97	5.20	41.91
5	34.98	15.86	0.85	51.70
6	80.53	21.72	0.59	102.84
7	19.62	15.45	1.07	36.15
8	17.12	13.21	0.69	31.03
9	16.20	19.21	0.84	36.25
10	18.42	16.48	1.75	36.65
11	24.59	12.44	0.37	37.40
12	26.07	10.39	1.62	38.08
13	N/A	17.93	2.36	20.29
Total (Within-district services ONLY)				46.59
Total (Out-of-district services included)				52.84

Source: Author's calculation.

From the analysis, we find that the total within-district alcohol-related healthcare costs among the Universal Health Coverage beneficiaries could be as much as 2.2 billion Thai Baht in 2011. This figure is composed of 1.4 billion Thai Baht from outpatient (OPD) services[15] (including Special OPD services) and 800 million Thai Baht from inpatient (IPD) services among

[13] Only reimbursement cost for beneficiaries registered within district are included.
[14] Only reimbursement cost for beneficiaries registered within district are included.
[15] From both within and out-of-district beneficiaries.

the within-district beneficiaries. These figures are lower than the estimates reported by HITAP in 2006, which equaled 2.5 billion Thai Baht for OPD services and 3 billion Thai Baht for IPD services.

The possible cause of differences in estimates is the sources of data. Our study uses the actual OPD cost reported by each health facility under the Universal Health Coverage scheme, while the HITAP study used the frequency and average cost of treatment (inflation-adjusted) for each disease group from the Center for Health Equity Monitoring (CHEM), Faculty of Medicine, Naresuan University, where the utilization information from 81 hospitals in 18 provinces in 2003 were recorded (HITAP, 2008).

Moreover, the HITAP study estimated the total IPD service costs from the beneficiaries under all schemes, namely, those under the CSMBS, the SSS, and the UHC, using data collected by the Central Office for Healthcare Information. It imposed assumptions that the number of inpatient admissions from those under CSMBS and UHC schemes accounted for 70% of all admissions taking place in 2006, and the average cost of 10,300 Baht per 1 Adjusted Relative Weight was employed. The distinction between services obtained within-district and outside-district was not recognized. The estimation was done at the national level rather than being district-specific. The current study focuses only on those under the UHC scheme and the average cost per admission comes from the reimbursement rates used by each NHSO district office. Our estimates are obtained under a less restrictive assumption and a more specific calculation.

Another possible reason for the difference is the lack of access to the information regarding the number of inpatient admissions from road traffic accidents. The cost of inpatient services from road traffic accidents ranked first in 2006 at 1.2 billion Thai Baht (40% of total inpatient cost), implying that it is the main drive of the high inpatient cost. Unfortunately, IPD records from the NHSO do not allow the identification whether those admissions were caused by road traffic accidents, only disease identification is possible.

Across the country, we find that the administrative district with the highest OPD cost from alcohol consumption per beneficiary is ***district 6,*** which covers the area of Rayong, Chanthaburi, Chachoengsao, Chon Buri, Trat,

Prachinburi, Samut Prakan, and Sa Kaeo. It is an area with many important industrialized zones, and a lot of those using the medical services might be temporary migrant workers who did not register in the area and who have no choice but to use out-of-district services.[16] This would suggest that alcohol consumption problems in these provinces are large and it might require serious attention from relevant agencies. The district with the smallest per-beneficiary OPD cost related to drinking is ***district 9***, which includes Nakhon Ratchasima, Chaiyaphum, Buri Ram, and Surin, from which most migrant workers originate. It could be the case that large number of registered beneficiaries never use services at home because they actually reside in other areas.

For severe treatment, such as inpatient services, ***district 1*** incurred the highest per-beneficiary alcohol-related cost, while ***District 12***, on the other hand, incurred the lowest. ***District 1*** provinces are those which are known to be tourist destinations in the Northern region of Thailand, namely, Chiang Mai, Chiang Rai, Phayao, Mae Hong Son, Nan, Lampang, Lamphun, and Phrae. It could be destination of many permanent migrants from other areas, causing some who might be severely ill to settle there.

The types of disease that impose financial burden on each administrative district of the NHSO are examined but are not reported here. Hypertension and AIDS are the two most common diseases consuming the largest OPD resources in every district for both genders.

For males, IPD resources were directed mostly to Oropharyngeal cancer, Haemorrhagic and other nonischaemic strokes, Alcoholic liver Cirrhosis, and liver cancer. Given that the top five causes of death among Thai men were strokes, road traffic accidents, Ischemic heart disease, liver cancer, and chronic obstructive pulmonary disease, respectively, in 2011 (IHPP, 2014), alcohol consumption could be one of the major culprits here.

For females, Alcoholic liver Cirrhosis, Oropharyngeal cancer, and Haemorrhagic and other nonischaemic strokes consumed the highest IPD resources. Stroke was the number one cause of death among Thai women in 2011 (IHPP, 2014), and this again sheds light on the harm caused by drinking.

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[16] This conclusion does not take into account the fact that district 13 could have higher per capita cost.

6. Sensitivity Analysis

Two sensitivity analyses were conducted in this paper.

First, to allow for different alcohol consumption patterns across areas (Table 5), Table 9 reports the NHSO district-specific healthcare costs calculated using individual set of AAFs for each district. That is, we use district-specific alcohol consumption prevalence rates to compute district-specific AAFs for each disease group and apply those specific AAFs to healthcare costs in each district.

Table 9. NHSO district-specific OPD IPD and Special OPD Cost attributable to alcohol (based on district-specific AAFs)

NHSO District Office	OPD cost (Baht)	IPD cost (Baht)	Special OPD cost (Baht)	Total cost (Baht)
1	196,709,982.37	134,091,920.34	7,116,546.51	337,918,449.22
2	135,777,156.23	52,726,123.93	4,541,724.75	193,045,004.91
3	71,770,637.88	42,510,005.26	426,602.72	114,707,245.86
4	69,491,048.75	62,768,701.38	16,750,300.70	149,010,050.83
5	124,897,311.66	64,016,930.78	3,019,764.95	191,934,007.39
6	325,905,043.50	87,773,311.94	2,392,014.57	416,070,370.01
7	76,905,749.48	51,295,007.78	4,281,579.11	132,482,336.37
8	74,162,577.65	46,474,135.03	3,081,518.19	123,718,230.87
9	83,666,525.21	91,210,292.17	4,343,598.17	179,220,415.55
10	63,861,091.67	52,505,497.70	6,247,340.45	122,613,929.82
11	66,331,833.24	38,858,135.12	1,008,804.28	106,198,772.64
12	58,410,663.69	31,055,118.87	3,842,157.74	93,307,940.30
13	N/A	69,076,629.31	7,984,387.88	77,061,017.19
Total (Within-district services ONLY)	1,347,889,621.33	824,361,809.61	65,036,340.02	2,237,287,770.96
Total (Out-of-district services included)				2,525,728,119.33

Table 10. NHSO district-specific OPD IPD and Special OPD Cost attributable to alcohol per beneficiary (based on district-specific AAFs)

NHSO District Office	OPD cost per Beneficiary (Baht)	IPD cost per Beneficiary (Baht)[17]	Special OPD cost per beneficiary (Baht)[18]	Total cost per beneficiary (Baht)
1	46.78	31.89	1.69	80.37
2	51.64	20.05	1.73	73.42
3	30.83	18.26	0.18	49.27
4	21.91	19.79	5.28	46.98
5	33.07	16.95	0.80	50.81
6	85.61	23.06	0.63	109.29
7	20.14	13.43	1.12	34.69
8	17.13	10.73	0.71	28.57
9	16.35	17.83	0.85	35.03
10	17.93	14.74	1.75	34.42
11	19.11	11.19	0.29	30.59
12	14.93	7.94	0.98	23.86
13	N/A	18.62	2.15	20.77
Total (Within-district services ONLY)				46.77
Total (Out-of-district services included)				52.80

Source: Author's calculation.

The conclusions about the highest-burden areas using district-specific AAFs are similar to those obtained using national AAFs. The total figures, however, are 0.38% larger.

Second, due to the fact that the use of Adjusted Relative Weight involves a strict estimation of healthcare resources used, in order to allow for the possibility of underestimation by this measure, we vary the assumptions

[17] Only reimbursement cost for beneficiaries registered within district are included.
[18] Only reimbursement cost for beneficiaries registered within district are included.

regarding actual healthcare resources used compared to the rules employed by the NHSO, the adjusted estimates are reported in Table 11.

Table 11. Total alcohol-related healthcare costs under different assumptions (based on National AAFs)

Assumptions	Total alcohol-related healthcare costs (Within-district services ONLY)	Total alcohol-related healthcare costs (Out-of-district services included)
Actual resources used are equal to reimbursement rate per 1 AdjRW	2,228,783,365.61	2,527,618,208.90
Actual resources used are higher than reimbursement rate per 1 AdjRW by 10%	2,312,469,746.96	2,637,688,868.06
Actual resources used are higher than reimbursement rate per 1 AdjRW by 30%	2,479,842,509.66	2,857,830,186.39
Actual resources used are higher than reimbursement rate per 1 AdjRW by 50%	2,647,215,272.36	3,077,971,504.73
Actual resources used are higher than reimbursement rate per 1 AdjRW by 70%	2,814,588,035.06	3,298,112,823.06

Source: Author's calculation.

The modified estimates suggest that the use of Adjusted Relative Weights could lead the total costs to be underestimated by as much as 21%. Readers should bear in mind that different assumptions could be an important source of biases and any proposed estimates should be taken with caution.

7. Limitations of the study

Despite the effort to strictly follow the methodology commonly employed in the alcohol-related cost estimation reports across many countries, there are still many caveats or limitations of the current study that the readers should be aware of.

First, the disease groups included in this study are not exhaustive, and different countries usually include different sets of disease groups depending on different incidences of the diseases in each country (and the availability of epidemiological studies of those diseases). To be comparable to previous

studies in Thailand, this study chose the same set of disease groups as previous works (HITAP, 2008). However, the change in illness patterns among the Thai population might justify the inclusion of new disease groups, this is not done in this paper, and the reported estimates lie on the assumption that no such illness pattern changes had occurred. Second, the exclusion of the outpatient cost of district 13, the Bangkok Metropolitan area, could underestimate the total cost figures, since this area had roughly 3.7 million registered beneficiaries in 2011. Moreover, the verification of outpatient cost reported by each health facility is very difficult to be done by the author, if possible, so we use all the cost records as is.

Third, the reported estimates in Section 5 are based on the assumption that alcohol consumption patterns are the same across areas, which might not be the case (see Table 5). Estimates using district-specific alcohol consumption prevalence rates (and AAFs) would be more accurate, as in Section 6, small biases are observed. Fourth, the underestimation caused by the use of AdjRW could be another limitation of the study. Section 6 tries to overcome this flaw, however.

Lastly, the calculation of alcohol consumption prevalence rates could be another source of biases as some respondents reported drinking but did not specify the consumption volume, leading to missing data which could cause imprecise calculation of prevalence rates. This study exercises minimum data manipulation by excluding all missing values of volume reported. All in all, the estimates provided in this paper should be considered as indicative, rather than as the precise healthcare costs of alcohol consumption.

8. Conclusion

This paper estimates the national and NHSO district-specific healthcare costs that can be linked to the Thai population's drinking behavior. The national cost for Universal Health Coverage beneficiaries obtaining services within registered areas could have been between 2.2-2.8 billion Thai Baht (approximately $73-$92 million) in 2011.

Moreover, set aside the Bangkok area, administrative district that covers large areas of industrialized zones incurred the highest alcohol-related

outpatient cost, although it is the most expensive in areas with many tourist destinations for inpatient services. The commonly known diseases such as Hypertensive disease, AIDS, Haemorrhagic and other nonischaemic strokes, liver cancer, Oropharyngeal cancer, Alcoholic liver Cirrhosis, and Laryngeal cancer are found to contribute significantly to alcohol-related healthcare costs in each area.

The majority of Thai people are covered under the Universal Health Coverage program, which is financed primarily from general tax revenue. This study sheds light on the areas which impose large financial burden on this health insurance scheme, the burden which is the result of preventable causes, especially drinking problems. Given the fact that this study provides only one component of externality cost from alcohol consumption, the overall externality cost could be much higher. This calls for the attention of relevant agencies and policy-makers to take serious action on this matter, in order to reduce the cost which could be avoided or lessened with proper policy instruments.

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